

What is claimed is:

1. A variable directivity antenna comprising:

at least two antenna elements each exhibiting a 8-shaped directivity pattern, said antenna elements being disposed generally in parallel
5 with and spaced from each other by a distance shorter than a quarter of a wavelength employed; and

combining means coupled to said at least two antenna elements via associated feeders having different lengths;

the difference in length between said feeders being such that
10 received signals resulting from reception by said at least two antenna elements of radio waves coming from a second direction opposite to a first direction toward and perpendicular to the length direction of said at least two antenna elements can be coupled in generally 180° out of phase to inputs of said combining means;

15 said variable directivity antenna further comprising variable phase means disposed between one of said at least two antenna elements and said combining means, said variable phase means being adapted to selectively assume a first state in which said variable phase means couples said received signal from said one antenna element to said combining means without
20 changing the phase of said signal, and a second state in which said variable phase means inverts the phase of said received signal from said one antenna element before coupling to said combining means.

2. The variable directivity antenna according to Claim 1 wherein said
25 received signals from said at least two antenna elements are amplified by amplifying means associated therewith before being coupled to said respective associated feeders.

3. The variable directivity antenna according to Claim 1 wherein said
30 at least two antenna elements are formed on a single printed circuit board.

4. The variable directivity antenna according to Claim 1 wherein said at least two antenna elements are dipole antennas having such lengths as to receive radio waves in a first frequency band;

5 said variable directivity antenna further including extension elements disposed in line with and outward of opposite ends of each said dipole antennas, the sum of the length of one of said dipole antennas and the lengths of said extension elements disposed outward of said one dipole antenna being such that said one dipole antenna and its associated extension
10 elements together can receive radio waves in a second frequency band lower than said first frequency band, the sum of the length of the other dipole antenna and the lengths of said extension elements disposed outward of said other dipole being such that said other dipole antenna and its associated extension elements together can receive radio waves in said second frequency
15 band; and

switch means being connected between said one dipole antenna and each of said associated extension elements, and between said other dipole antenna and each of said associated extension elements.

20 5. A variable directivity antenna system comprising:
an antenna set including first and second antennas each comprising a variable directivity antenna as defined by Claim 1, said first and second antennas being disposed to orthogonally intersect with each other;

a level adjusting arrangement including first level adjusting means
25 to which a received signal from said first antenna is applied, and second level adjusting means to which a received signal from said second antenna is applied, said first level adjusting means adjusting a level of said received signal from said first antenna in accordance with a first level control signal and outputting the level adjusted signal, said second level adjusting means
30 adjusting a level of said received signal from said second antenna in

accordance with a second level control signal and outputting the level adjusted signal;

combining means for combining at least output signals of said first and second level adjusting means; and

5 level control signal generating means for generating said first and second level control signals, said first level control signal varying in a sine waveform fashion within a first variation range from zero through a predetermined first value to zero, said second level control signal varying in a cosine waveform fashion in a second variation range from said first value
10 through zero to a second value having an absolute value equal to but an opposite sign to said first value, in synchronization with said first level control signal.

6. The variable directivity antenna system according to Claim 5
15 further comprising:

variable filter means including first and second variable filters, said first variable filter receiving said received signal from said first antenna and having a passband variable in accordance with a first passband varying signal, said second variable filter receiving said received signal from said
20 second antenna and having a passband variable in accordance with a first passband varying signal; and

passband varying signal generating means for providing said first and second variable filters with said first and second passband varying signals so as to make said first and second variable filters pass therethrough a
25 desired radio wave to be received.

7. The variable directivity antenna system according to Claim 6 wherein, when said level control signal generating means is providing said first and second level control signals to provide said antenna system with
30 directivity for a desired radio wave to be received, said passband varying

signal generating means provides said first and second passband varying signals to make said first and second variable filters pass therethrough said desired radio wave.

5 8. The variable directivity antenna system according to Claim 7 further comprising a receiving apparatus to which a received signal from said antenna system is coupled through a transmission line, said receiving apparatus transmitting, to said level control signal generating means through said transmission line, a command commanding said level control signal
10 generating means to generate said first and second level control signals having desired values.

9. The variable directivity antenna system according to Claim 8 wherein said receiving apparatus includes memory means for storing therein
15 data relating to a desired channel in which a signal to be received is transmitted, and antenna control data for said desired channel in association with each other, the first and second level control signals and first and second passband varying signals for said desired channel being generated in accordance with said antenna control data; and wherein, while said receiving
20 apparatus is receiving said desired channel, said antenna control data for said desired channel is read out from said memory means and is transmitted to said level control signal generating means and to said passband varying signal generating means through said transmission line.

25 10. The variable directivity antenna system according to Claim 9 wherein:

after said receiving apparatus has been set to a state in which said desired channel signal can be received, and while said first and second passband varying signals are being applied to said first and second variable
30 filter means so as to pass said desired channel signal therethrough, said first

and second level control signals are varied, while monitoring the reception state of said receiving apparatus, and the first and second level control signals providing an allowable reception state are determined; and

5 a data piece relating to the determined first and second level control signals, and a data piece relating to the first and second passband varying signals applied to said passband varying signal generating means when said allowable reception state is provided, are stored in said memory means as said antenna control data.

10 11. The variable directivity antenna system according to Claim 9 wherein:

when the reception state of said desired channel signal at said receiving apparatus becomes unallowable, said first and second level control signals are successively varied, and the reception state at said receiving
15 apparatus is monitored to determine the first and second level control signals providing an allowable reception state, while applying the first and second passband varying signals to said first and second variable filter means so as to pass said desired channel signal therethrough; and

data relating to the first and second level control signals for
20 providing said allowable reception state is substituted for the previous data relating to the first and second level control signals in said antenna control data.

12. The variable directivity antenna system according to Claim 5
25 wherein said received signals from said at least two antenna elements are amplified by amplifying means associated therewith before being coupled to said respective associated feeders.

13. The variable directivity antenna system according to Claim 5
30 wherein said at least two antenna elements are formed on a single printed

circuit board.

14. A variable directivity antenna system comprising:

an antenna set including first and second antennas each
5 comprising a variable directivity antenna as defined by Claim 4, said first and second antennas being disposed to orthogonally intersect with each other;

a level adjusting arrangement including first level adjusting means to which a received signal from said first antenna is applied, and second level adjusting means to which a received signal from said second antenna is
10 applied, said first level adjusting means adjusting a level of said received signal from said first antenna in accordance with a first level control signal and outputting the level adjusted signal, said second level adjusting means adjusting a level of said received signal from said second antenna in accordance with a second level control signal and outputting the level
15 adjusted signal;

combining means for combining at least output signals of said first and second level adjusting means; and

level control signal generating means for generating said first and second level control signals, said first level control signal varying in a sine
20 waveform fashion within a first variation range from zero through a predetermined first value to zero, said second level control signal varying in a cosine waveform fashion in a second variation range from said first value through zero to a second value having an absolute value equal to but an opposite sign to said first value, in synchronization with said first level control
25 signal.

15. The variable directivity antenna system according to Claim 14 further comprising:

variable filter means including first and second variable filters,
30 said first variable filter receiving said received signal from said first antenna

and having a passband variable in accordance with a first passband varying signal, said second variable filter receiving said received signal from said second antenna and having a passband variable in accordance with a first passband varying signal; and

5 passband varying signal generating means for providing said first and second variable filters with said first and second passband varying signals so as to make said first and second variable filters pass therethrough a desired radio wave to be received.

10 16. The variable directivity antenna system according to Claim 15 wherein, when said level control signal generating means is providing said first and second level control signals to provide said antenna system with directivity for a desired radio wave to be received, said passband varying signal generating means provides said first and second passband varying
15 signals to make said first and second variable filters pass therethrough said desired radio wave.

17. The variable directivity antenna system according to Claim 16 further comprising a receiving apparatus to which a received signal from said
20 antenna system is coupled through a transmission line, said receiving apparatus transmitting, to said level control signal generating means through said transmission line, a command commanding said level control signal generating means to generate said first and second level control signals having desired values.

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18. The variable directivity antenna system according to Claim 17 wherein said receiving apparatus includes memory means for storing therein data relating to a desired channel in which a signal to be received is transmitted, and antenna control data for said desired channel in association
30 with each other, the first and second level control signals and first and second

passband varying signals for said desired channel being generated in accordance with said antenna control data; and wherein, while said receiving apparatus is receiving said desired channel, said antenna control data for said desired channel is read out from said memory means and is transmitted to
5 said level control signal generating means and to said passband varying signal generating means through said transmission line.

19. The variable directivity antenna system according to Claim 18 wherein:

10 after said receiving apparatus has been set to a state in which said desired channel signal can be received, and while said first and second passband varying signals are being applied to said first and second variable filter means so as to pass said desired channel signal therethrough, said first and second level control signals are varied, while monitoring the reception
15 state of said receiving apparatus, and the first and second level control signals providing an allowable reception state are determined; and

a data piece relating to the determined first and second level control signals, and a data piece relating to the first and second passband varying signals applied to said passband varying signal generating means
20 when said allowable reception state is provided, are stored in said memory means as said antenna control data.

20. The variable directivity antenna system according to Claim 18 wherein:

25 when the reception state of said desired channel signal at said receiving apparatus becomes unallowable, said first and second level control signals are successively varied, and the reception state at said receiving apparatus is monitored to determine the first and second level control signals providing an allowable reception state, while applying the first and second
30 passband varying signals to said first and second variable filter means so as

to pass said desired channel signal therethrough; and

data relating to the first and second level control signals for providing said allowable reception state is substituted for the previous data relating to the first and second level control signals in said antenna control
5 data.

21. The variable directivity antenna system according to Claim 14 wherein said received signals from said at least two antenna elements are amplified by amplifying means associated therewith before being coupled to
10 said respective associated feeders.

22. The variable directivity antenna system according to Claim 14 wherein said at least two antenna elements are formed on a single printed circuit board.

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